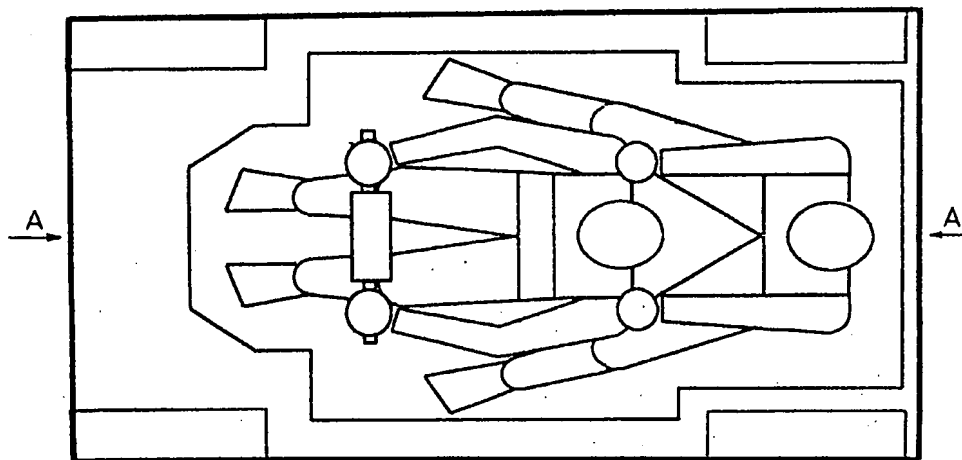




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: CITY-CAR



## (57) Abstract

A four-wheel city-car of small overall dimension, of a type comprising a structural frame covered by a car body, and a front seat and rear seat aligned to each other along a longitudinal vehicle axis, wherein the rear seat is of motorbike style and placed close against the front seat, to accommodate a passenger astride said longitudinal axis.

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## CITY-CAR

Technical Field

This invention relates to a four-wheel city-car. In particular, the invention relates to a four-wheel city-car of small overall dimension, being of a type which comprises a structural frame covered by a car body, and a front seat and a rear seat aligned to each other along a longitudinal vehicle axis.

Background Art

10 As is known, the problem of an expanding street traffic in large cities and of controlling such a congested vehicular movement is a growing concern. Hence the need for new schemes of improving transportation and/or the utilization of parking space by the provision of cars  
15 which are small in size but retain the comfort features of latest generation cars.

The recent presentation to the general public of the SMART project, European Patent Application No. 0 669 245, as a joint undertaking of the car manufacturer  
20 Mercedes-Benz and the company SWATCH, attracted considerable interest. The above European application discloses a small two-seater car having its seats laid generally side-by-side but slightly offset from each other.

25 In the wake of this and other similar developments in the car industry, the proposals and designs for small city cars that could be used even by young people uneligible for a driving license have gained fresh impetus.

30 These small city cars are classed as "cycle cars" by the regulations on account of the limited power of

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their engine and of their small weight. However, they cannot attain high travel speeds, and although solving the problem of reduced space occupation by accomodating only two people, they are definitely inferior in comfort and overall performance. In fact, such cycle cars are unsuitable to move away from city traffic jams and to provide safe and comfortable travelling conditions on bypass roads or belt highways around the urban nuclei of big cities.

10 Furthermore, while these cycle cars do optimize the seating arrangement for two people side-by-side, they leave very little room between the occupants and the interior compartment walls. Thus, the living space is extremely reduced in case of serious crashes.

15 It will be appreciated from the above considerations that the solution currently provided by the state of the art to the problem of reducing the overall size of city cars is that of seating only two passengers side by side. But this can provide a major reduction in the lengthwise dimension only.

20 There have been prior proposals, however, for four-wheel vehicles which can accommodate two people seating one behind the other. For example, UK Patent No. 1 412 704 discloses a high-performance lightweight vehicle intended for young athletic drivers. In this vehicle, the two seats are laid in a tandem arrangement inside the cockpit.

The streamlined and lightweight character of such a vehicle rules it out, however, for city use.

30 US Patent No. 3,850,472 discloses a small size car comprising two structurally independent portions which are hinged together at the vehicle middle. This design allows the car to be essentially folded up such that

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one portion fits partway inside the other, thereby reducing the car parking space requirements, for example. Not even this solution suits the current trend in car design, since it fails to meet the requirements  
5 for car riding safety.

The underlying technical problem of this invention is to provide a city-car of an extremely compact size which can hold its own, both in terms of active and passive safety for its occupants, and of riding  
10 comfort, with the general standard in the car industry. This city-car should have such structural and functional features as to combine a small volume with an adequate propulsion and effective active and passive safety arrangements.

15 Disclosure of Invention

The concept behind this invention is one of providing a four-wheel city-car having two seats laid one behind the other, so as to leave a sufficient living space between the occupants and the car body sidewalls, and  
20 having the general features of a motorbike, such that it is easily handled, practical to drive, and suitable for frequent use inside the city. Furthermore, in the city-car of this invention, the compartment accommodating the passenger is placed inside a cage- or  
25 basket-like structure and at a higher level than the driver's seat, so that the passenger can be adequately protected without depressing the driver's safety level.

Based on this concept, the technical problem is solved by a city-car for city use as previously indicated and  
30 characterized in that the rear seat is of motorbike style and placed close against the front seat, to accommodate a passenger astride said longitudinal axis. Advantageously, the doors of the city-car comprise

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passive safety members, such as shockproof bars.

In addition, the rear seat is provided with a seat plate and a backrest, the backrest being hinge-mounted to one end of the seat plate.

- 5 Additional features and advantages of the city-car according to the invention will be apparent from the following description of an embodiment thereof, given by way of non-limitative example with reference to the accompanying drawings.

10 Brief Description of Drawings

In the drawings:

Figure 1 is a general view in perspective of a small size city car embodied in accordance with this invention;

- 15 Figure 1A is a schematic side view of the vehicle according to the invention;

Figure 2 is a perspective view of the vehicle shown in Figure 1 in a possible condition of its use, with the doors removed;

- 20 Figure 2A is a perspective view showing schematically a structural frame of the city-car of Figure 1;

Figure 3 is a sectional view of the structural frame shown in Figure 2A as assembled in the city-car of this invention;

- 25 Figure 4 is a plan view of the construction of the structural frame of Figure 2A;

Figure 5 is a perspective view showing schematically a lower frame portion;

- 5 -

Figure 6 is a perspective view showing schematically an upper frame portion;

Figure 7 is a schematic sectional view from above of the city-car of Figure 1;

- 5    Figures 8 and 9 illustrate the movable seat feature of the city-car;

Figure 10 is a front view of an embodiment of a city-car seat;

- 10    Figure 11 is a sectional view of the inventive city-car bringing out certain passive safety members;

Figure 12 is a plan view of the embodiment shown in Figure 11;

Figure 13 is a sectional view of the inventive city-car showing fuel tank and engine compartments thereof;

- 15    Figure 14 is a plan view of Figure 13;

Figure 15 is a cross-section through the city-car of this invention, showing such details as battery, spare wheel and radiator compartments;

Figure 16 is a plan view of Figure 15.

- 20    Modes for Carrying Out the Invention

Referring to the drawing views, shown at 1 is a four-wheel city-car according to the invention. This car 1 has a structural frame 2 which comprises essentially two parts: a lower frame 3 and an upper frame 4. The  
25    frame 2 is covered by a car body of sheet metal or a synthetic plastics material such as Kevlar. This car body is formed of shaped panels which are assembled detachably to the frame 2 and envelop the structural frame 2 shell-fashion.

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The upper frame 4 is secured rigidly on the lower frame 3, as shown in Figure 4. In this way, the entire construction of the structural frame 2 is made specially rigid and capable of accommodating a given amount of impact energy in a crash.

The lower frame 3 comprises a forward portion 5, a mid-portion 6, and a rearward portion 7. The forward portion 5 comprises a front element 8 and a front set 8A, both vertically upright and rectangular in shape. The front set 8A is larger than the front element 8, and the major side of the front set 8A represents the clearance width of the city-car 1.

The front element 8 is connected to the front set 8A by angular arms 9 which are welded to each corner edge of the front element 8. The presence of these angular arms 9 provides deformability for the forward portion 5 to absorb impact energy in a head-on collision. The front set 8A is also connected fixedly to the mid-portion 6. Thus, the city-car 1 is provided with a rigid inner structure which surrounds the interior compartment, and a deformable outer structure for cushioning possible shocks. The middle and rearward portions 6, 7 are joined by longitudinally extending side longitudinal members 10 which are designed and shaped to act as load-bearing members for the whole city-car 1. The rearward portion 7 also comprises a pair of rods 11 which connect one end of the rearward portion 7 to the mid-portion 6.

Advantageously, this rod pair 11 is inclined to an ideal horizontal plane substantially containing the city-car floor. In particular, the rods 11 extend from the mid-portion 6 toward the end of the portion 7 which locates at a level above said ideal horizontal plane.



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The car of this invention is equipped with two seats, a front seat 12 for the driver and a rear seat 13 for an optional passenger. These two seats 12, 13 are aligned to each other along a longitudinal axis, designated A-A  
5 in Figure 7. The rear seat 13 is positioned close against the front seat 12, such that the passenger is sitting astride said longitudinal axis A-A. Advantageously, the rear seat 13 locates at a higher level than the front seat 12.

10 Thus, the rear seat 13 is placed inside a cage or basket 2A comprised of the rearward portion of the structural frame 2, and the passenger is adequately protected. In particular, the design of the rear seat 13 is of motorbike inspiration, as clearly shown in the  
15 Figures, and the passenger will take a posture in the car 1 much like that of a passenger sat astride a motorbike saddle seat.

This feature is sure to meet the approval of motorcycling enthusiasts, who will enjoy travelling in  
20 this posture.

The rear seat 13 comprises basically a seat plate 14, whereto a backrest 15 is hingedly connected. As shown in Figure 8, when the seat 13 is not in use, the backrest 15 can be conveniently tilted down onto the  
25 seat plate 14 and used as a shelf.

Preferably, the front seat 12 is mounted on slideways, and can be slid along the longitudinal axis A-A for passenger's convenience in entering the city-car 1.

By displacing the front seat 12 on the slideways along  
30 the longitudinal axis A-A, the seat can be locked a selected distance apart from the rear seat 13 to provide comfortable legroom for the passenger.

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A possible embodiment of the front seat 12, shown in Figure 10, is provided with a pair of oppositely located handles 16 formed in the top portion of its backrest for the passenger to hold on during the ride.

5 Shown in Figure 12 is a door 17 of the city-car 1 according to the invention. Advantageously, this door is hinged to the front set 8A. In particular, each door 17 incorporates a structural frame which is hinged to the structural frame 2 of the city-car 1 in a manner  
10 known per se.

The structural frame of each door 17 is strengthened by passive safety members, such as shockproof bars 28. In addition, each door 17 comprises a first panel portion 18 having a window removably closed by a clear  
15 material, such as glass, and a second panel portion 19 covered by a portion of the car body.

If desired, the doors 17 of the city-car 1 can be easily removed from their mounts, and the city-car 1 used as an open city-car, as shown in Figure 2.

20 Alternatively, the city-car 1 of this invention could be equipped with a single door, or with a rear door.

It should be further mentioned, to complete the description, that the city-car 1 is provided with a fuel tank 21 formed from a synthetic plastics material.  
25 This tank is advantageously of molded construction to a flattened wide shape adapted to fit in the mid-portion 6 of the lower frame, as shown in Figures 13 and 14.

An adequate propulsion and drive is envisaged for the city-car 1. For example, an engine /transmission unit  
30 22 is mounted beneath the rod pair 11. In this way, on the occurrence of a rear bump, the engine unit 22 would slide under the frame 2 without injury to the car

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occupants.

In the preferred embodiment, given herein by way of non-limitative example, the drive is communicated to the rear wheels.

- 5 Advantageously, a storage battery 23 is stowed under the front seat 12, and a spare wheel 24 is stowed under the forward portion 5 of the lower frame 3. Radiators 25 are mounted out in front of said forward portion 5.

- 10 It will be appreciated from the foregoing description that the city-car of this invention does solve the technical problem, and achieves several advantages, among which the fact is outstanding that the lengthwise and crosswise dimensions of this city-car are far smaller than those provided by prior designs in this  
15 specific field.

- Furthermore, the interior space afforded to the occupants of the city-car is adequate to allow the car to incorporate the latest passive safety features, such as airbags for the driver and the passenger, and  
20 lateral airbags. In essence, despite its small overall dimension, the small size car of this invention allows of a sufficient living and safety space between the driver, the passenger and the car body sidewalls for such passive safety members to display their full  
25 effectiveness. Modifications and changes may be made unto the city-car of this invention within the scope of the following claims.

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## CLAIMS

1. Four-wheel city-car (1) of small overall dimension, being of a type which comprises a structural frame (2) covered by a car body, and a front seat (12) and a rear seat (13) aligned to each other along a longitudinal vehicle axis (A-A), characterized in that the rear seat (13) is of motorbike style and placed close against the front seat (12), to accommodate a passenger astride said longitudinal axis.
2. A city-car according to Claim 1, characterized in that the structural frame (2) comprises an upper frame (4) mounted fixedly on a lower frame (3), and that this construction is covered by a car body formed of synthetic plastics material panels.
3. A city-car according to Claim 2, characterized in that the structural frame (2) comprises a cage- or basket-like construction (2A) receiving the rear seat (13).
4. A city-car according to any of the preceding claims, characterized in that the rear seat (13) comprises a seat plate (14) and a backrest (15) hinged to one end of the seat plate (14).
5. A city-car according to any of the preceding claims, characterized in that it comprises at least one door (17).
6. A city-car according to Claim 2, characterized in that said lower frame (3) comprises a forward portion (5), a middle portion (6) and a rearward portion (7), the forward portion including a front element (8) and a front set (8A), both vertically upright, the front element (8) being connected by the front set (8A) by

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deformable angular arms (9).

7. A city-car according to Claim 1, characterized in that it comprises two doors (17).

8. A city-car according to Claims 6 and 7,  
5 characterized in that said two doors (17) are respectively hinged to opposite sides of said front set (8A).

9. A city-car according to Claims 5 and 6,  
10 characterized in that said at least one door (17) is hinged to the front set (8A).

10. A city-car according to Claim 6, characterized in that said rearward portion (7) comprises a pair of rods (11) interconnecting one of its ends and the middle portion (6) of the frame (2), this rod pair (11) lying  
15 at an angle of inclination to an ideal horizontal plane containing the city-car floor.

11. A city-car according to Claim 10, characterized in that an engine unit (22) is mounted slidably beneath said rod pair (11), for sliding under the structural  
20 frame (2) under a collision impact.

12. A city-car according to any of the preceding claims, characterized in that it comprises a fuel tank (21) having a wide flattened shape.

13. A city-car according to Claim 12, characterized in  
25 that said fuel tank (21) is received within the middle portion (6) of the structural frame (2).

14. A city-car according to Claim 5, characterized in that said at least one door (17) comprises passive safety members.

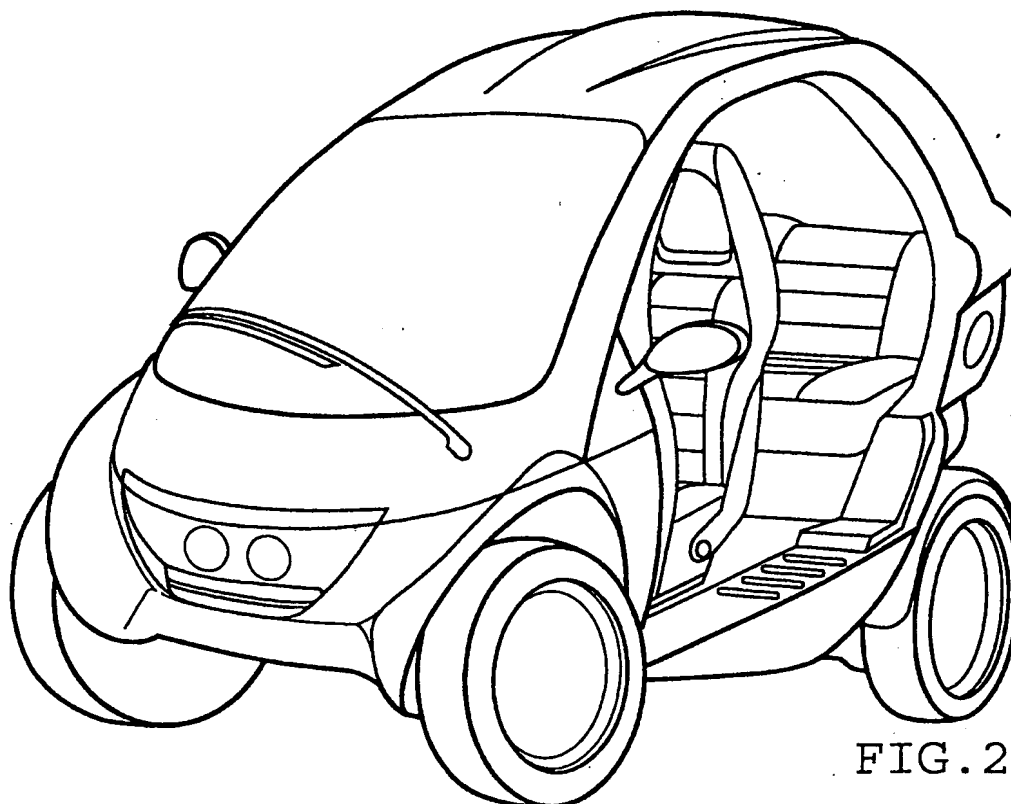
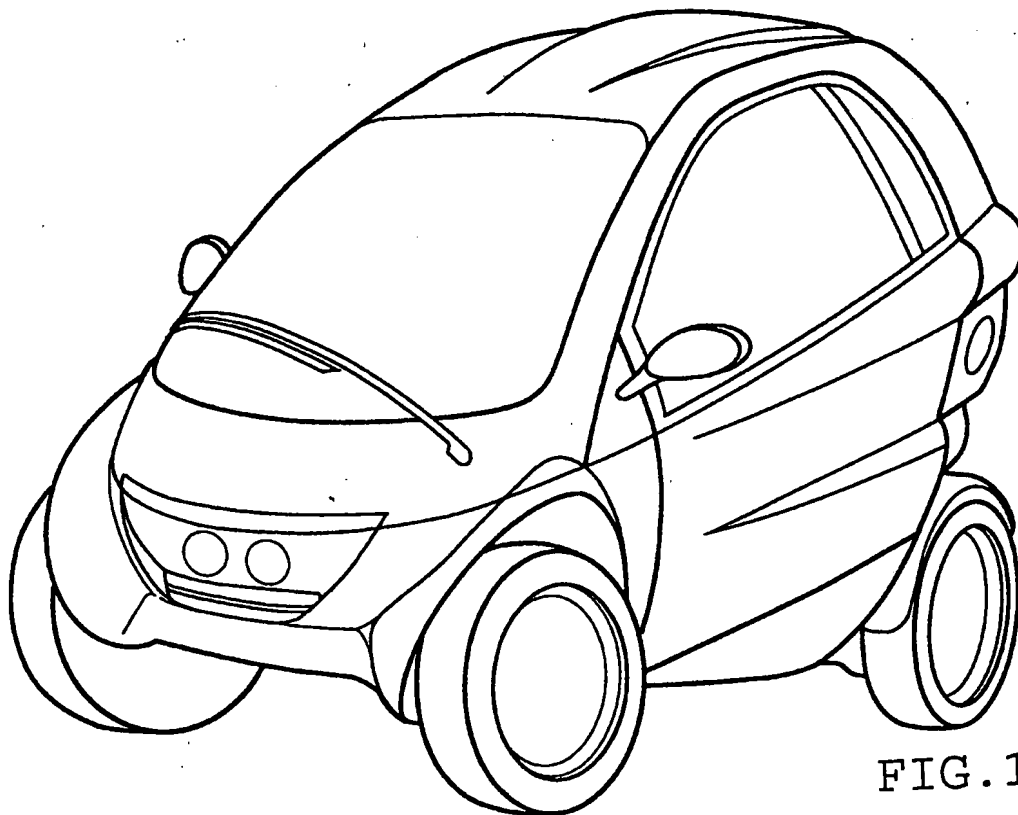
30 15. A city-car according to Claim 14, characterized in

- 12 -

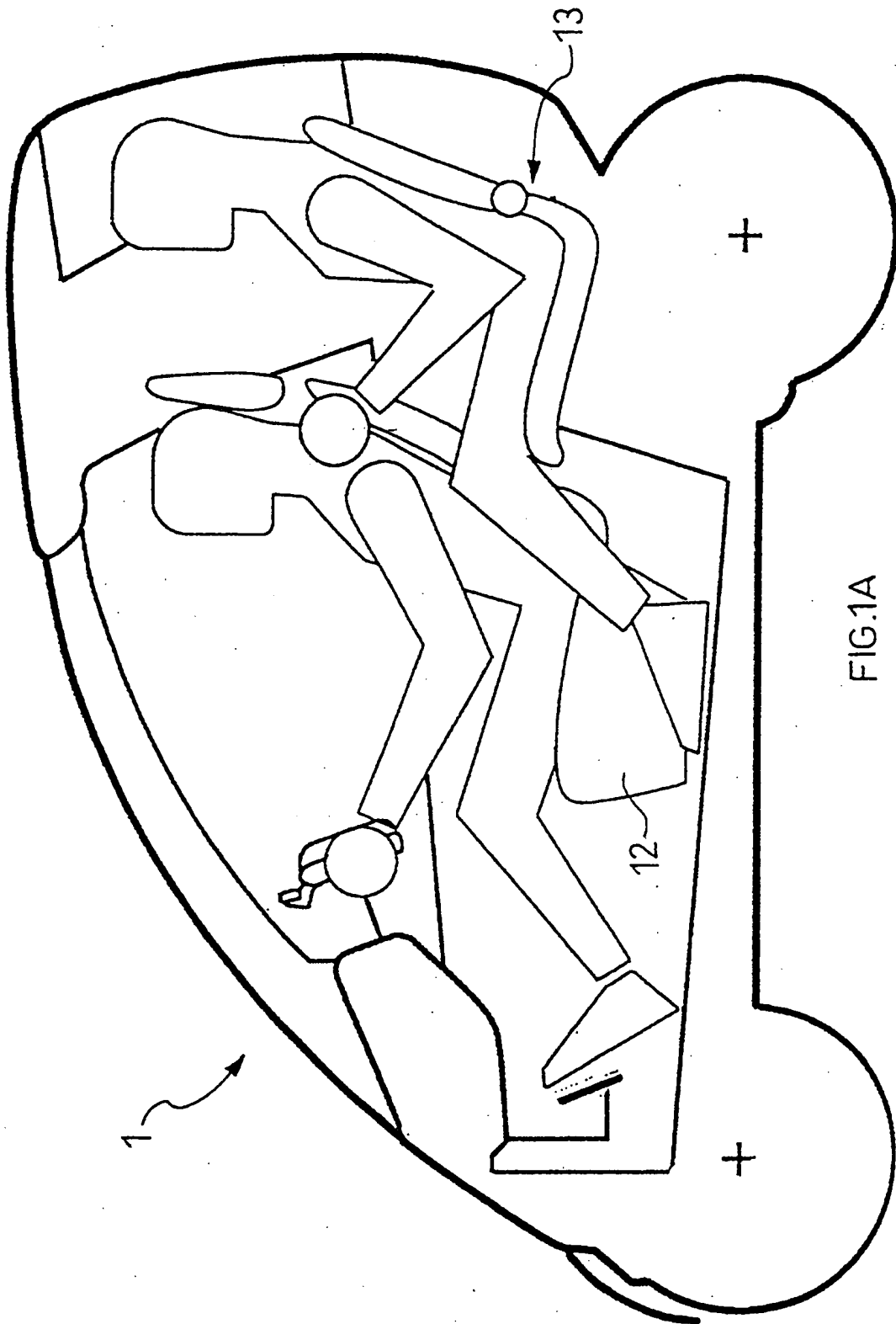
that said passive safety members comprise at least one shockproof bar.

16. A city-car according to Claim 14, characterized in that said passive safety members comprise at least one  
5 lateral airbag.

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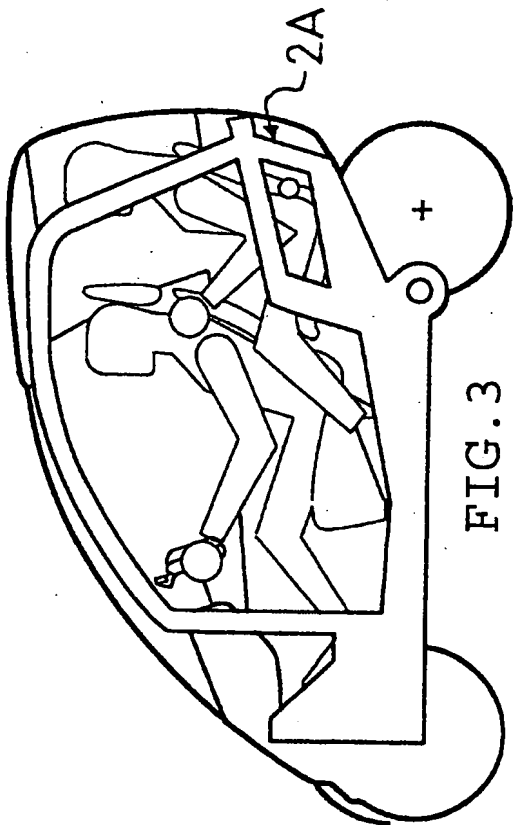


FIG. 3

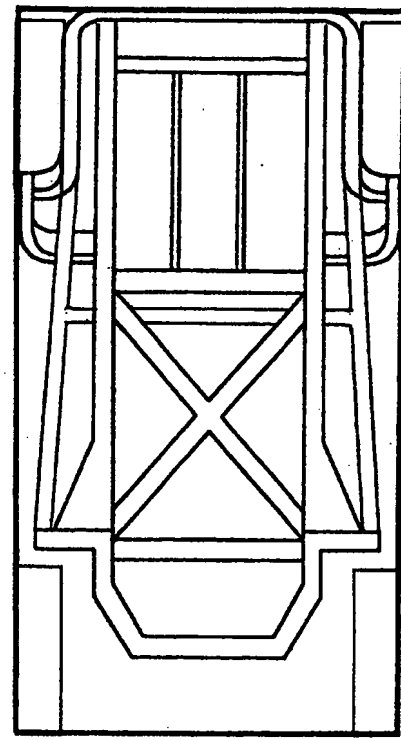


FIG. 4

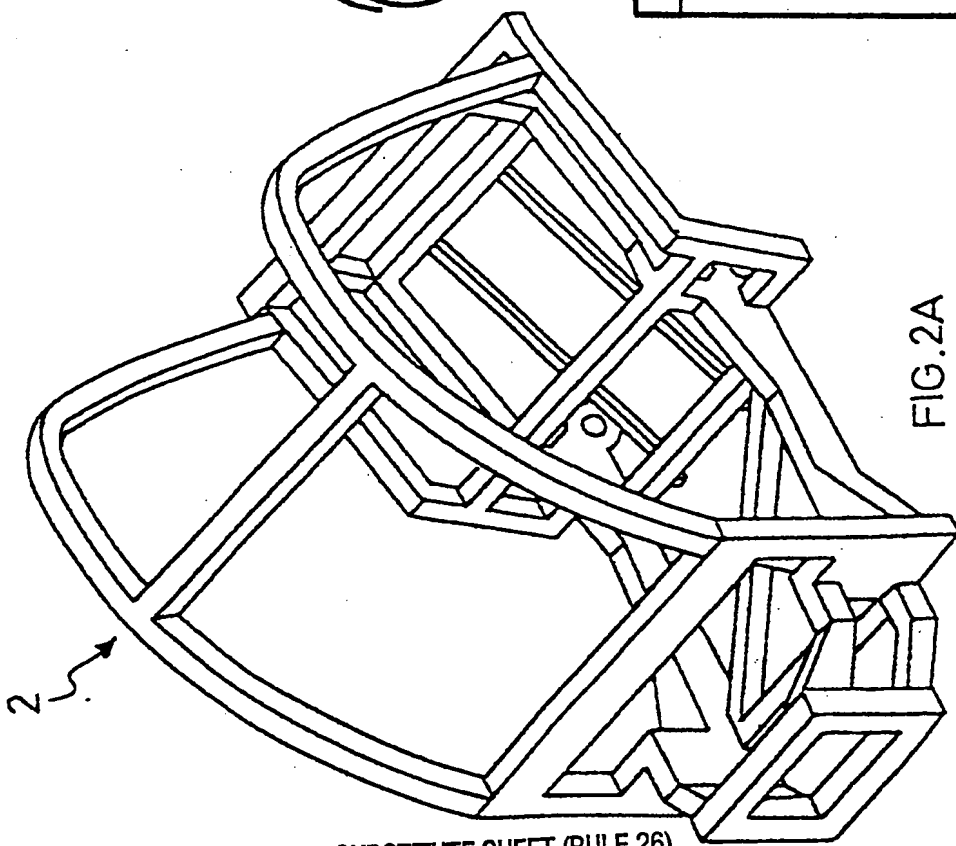
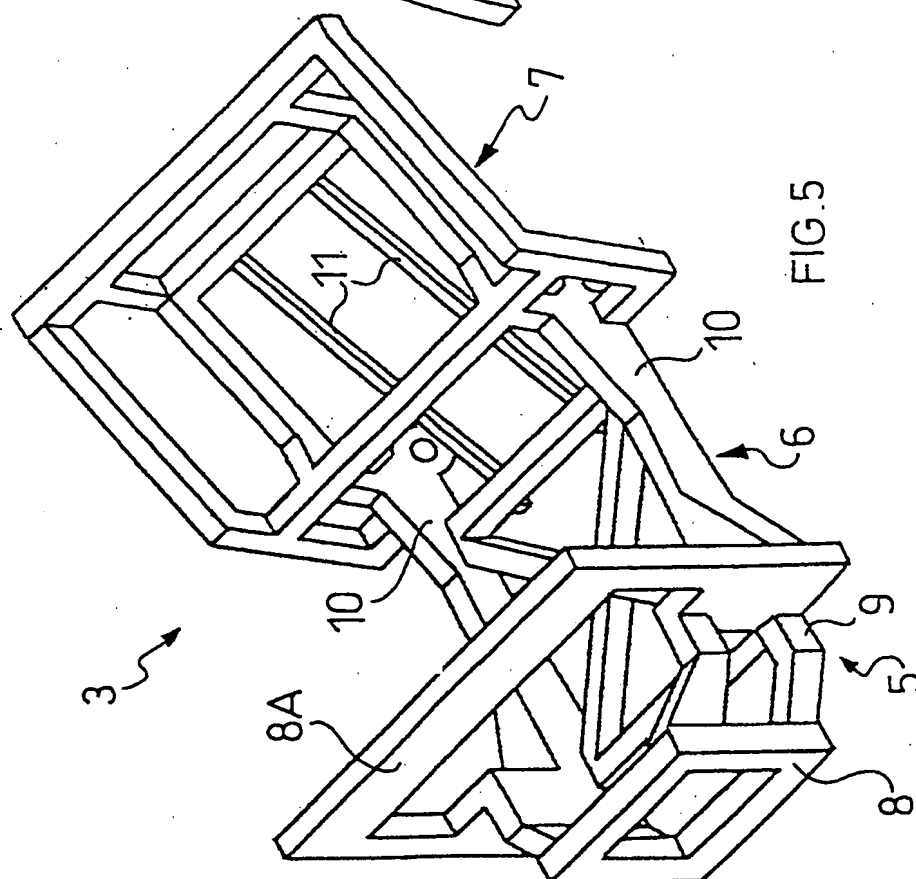
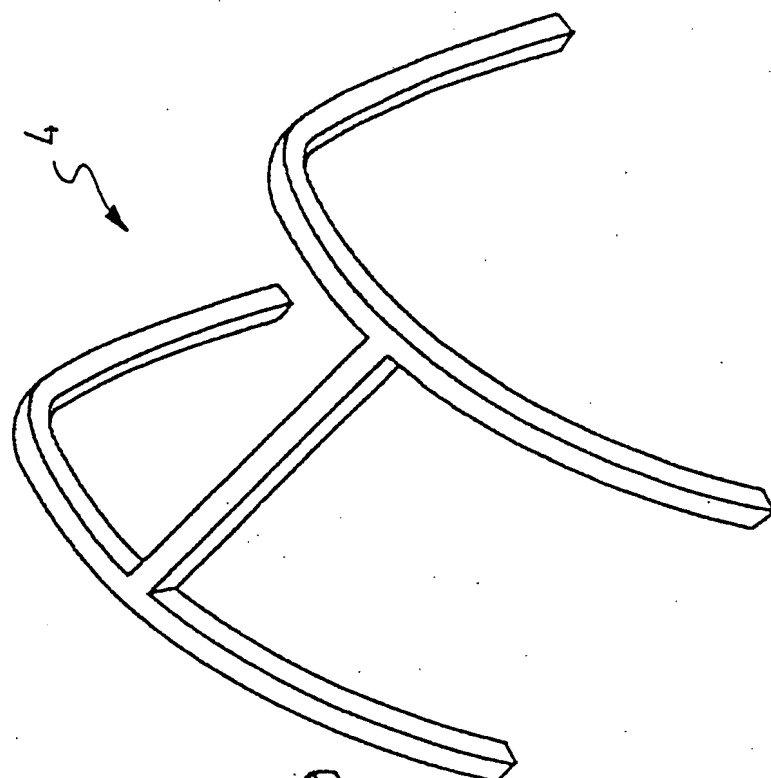


FIG. 2A

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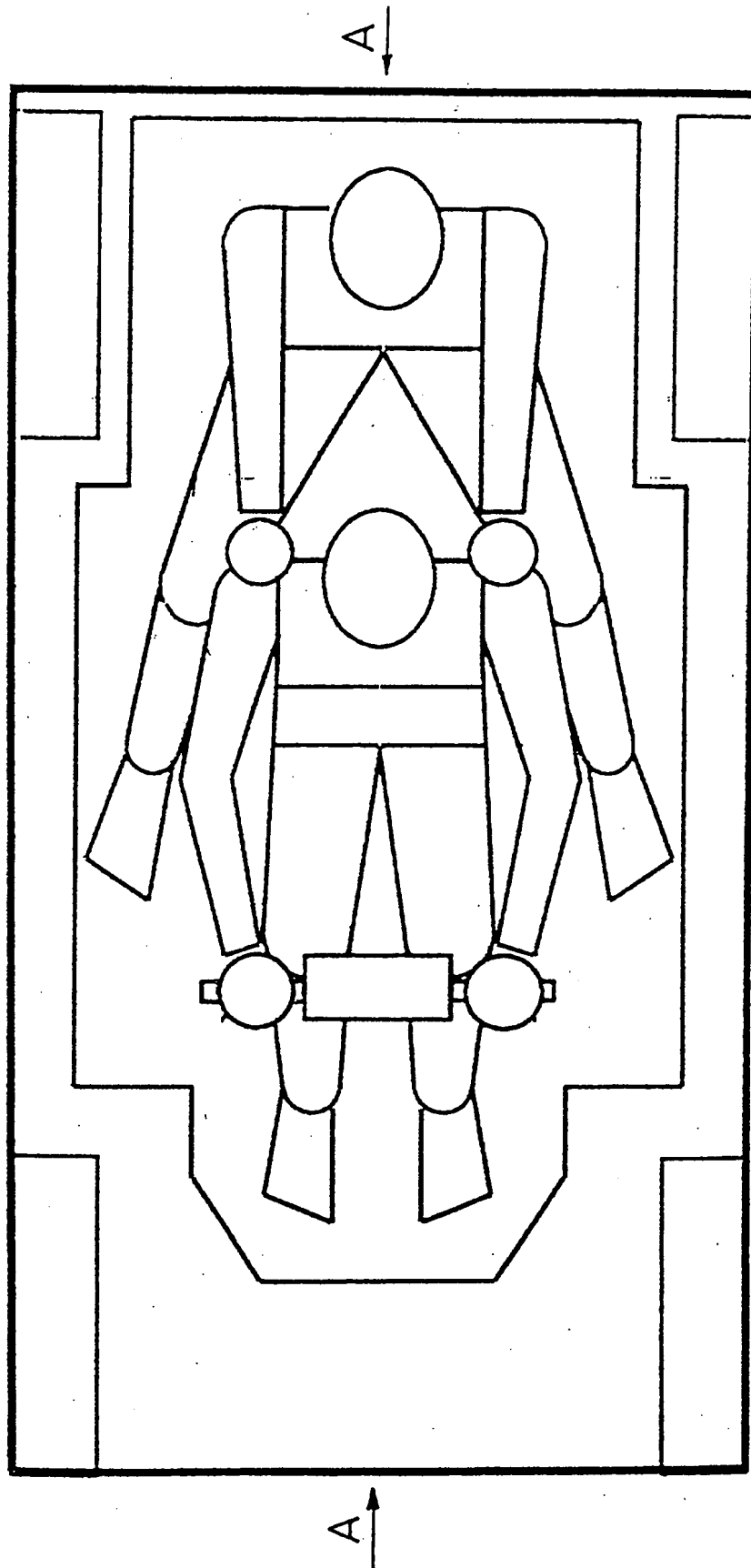
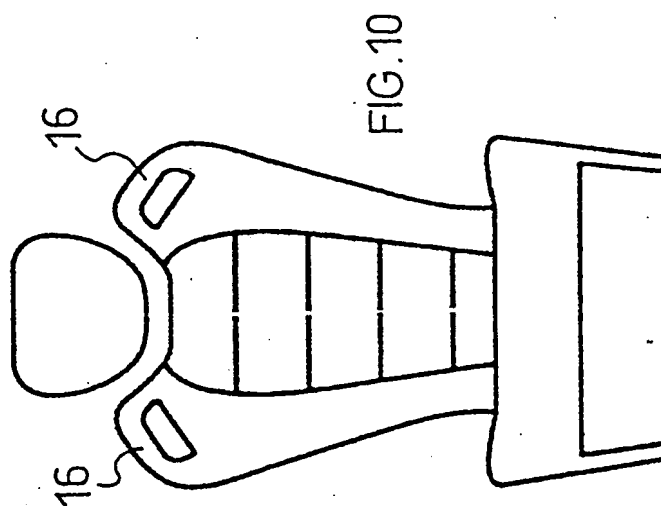
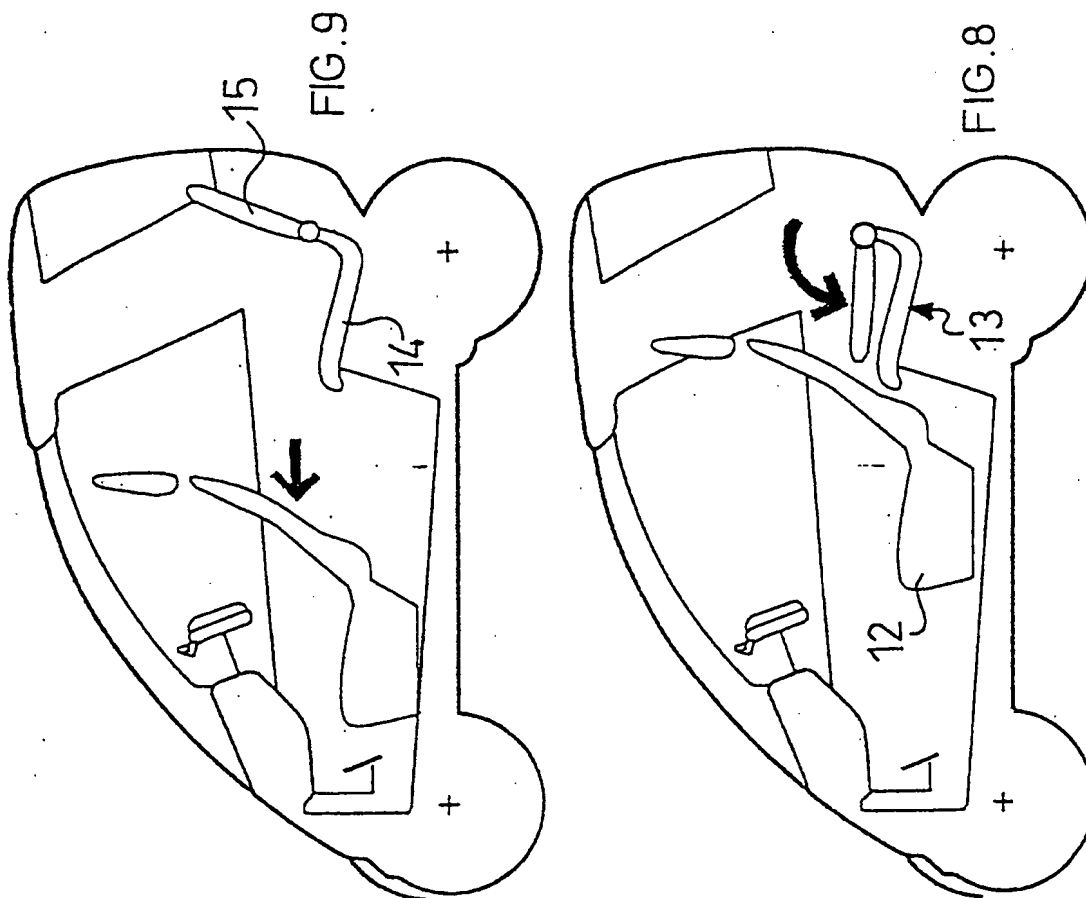


FIG. 7



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FIG. 11

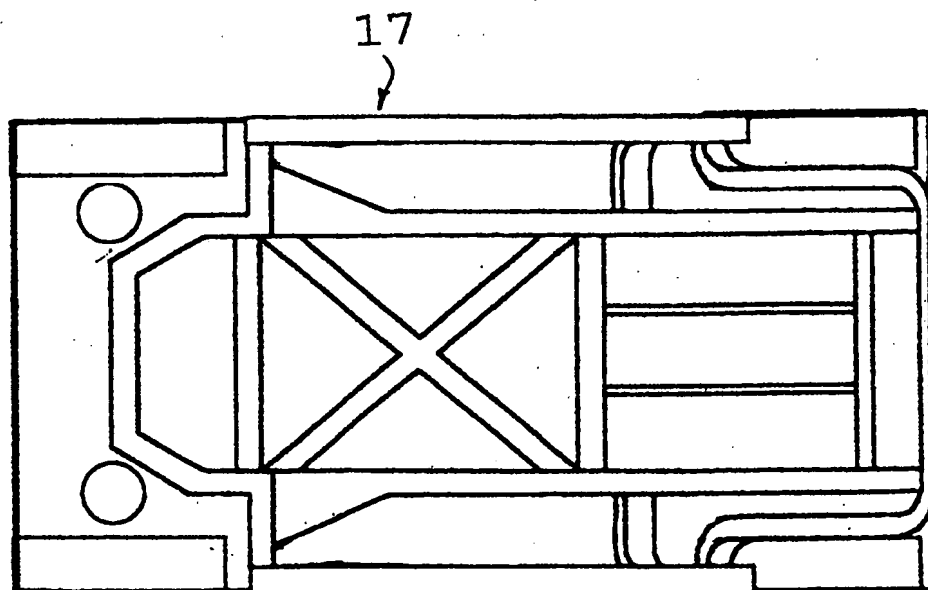
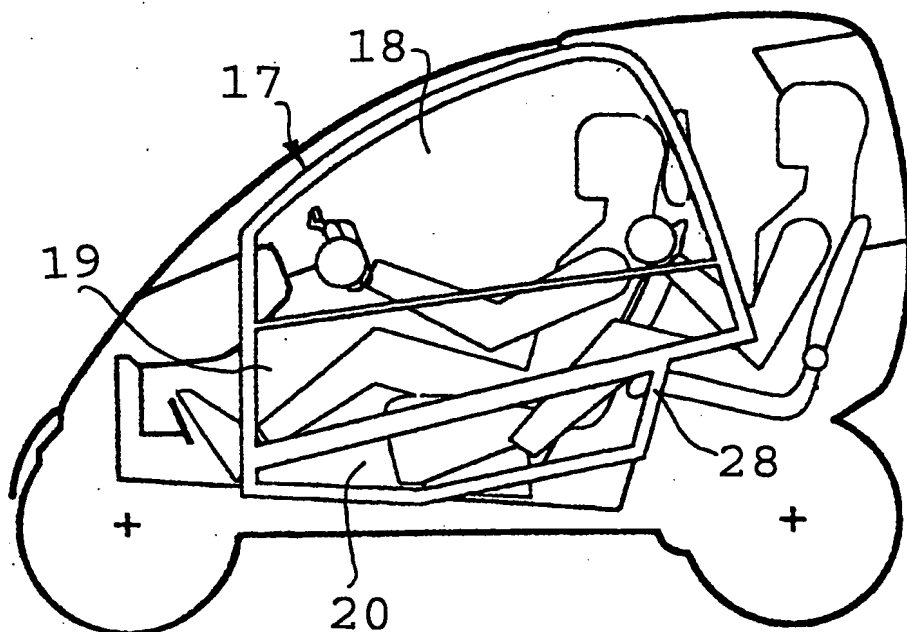


FIG. 12

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FIG. 13

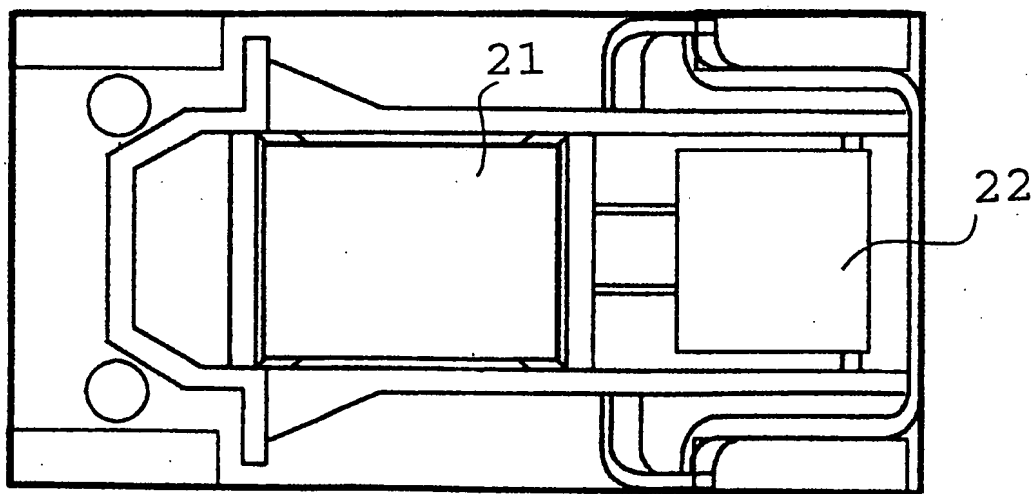
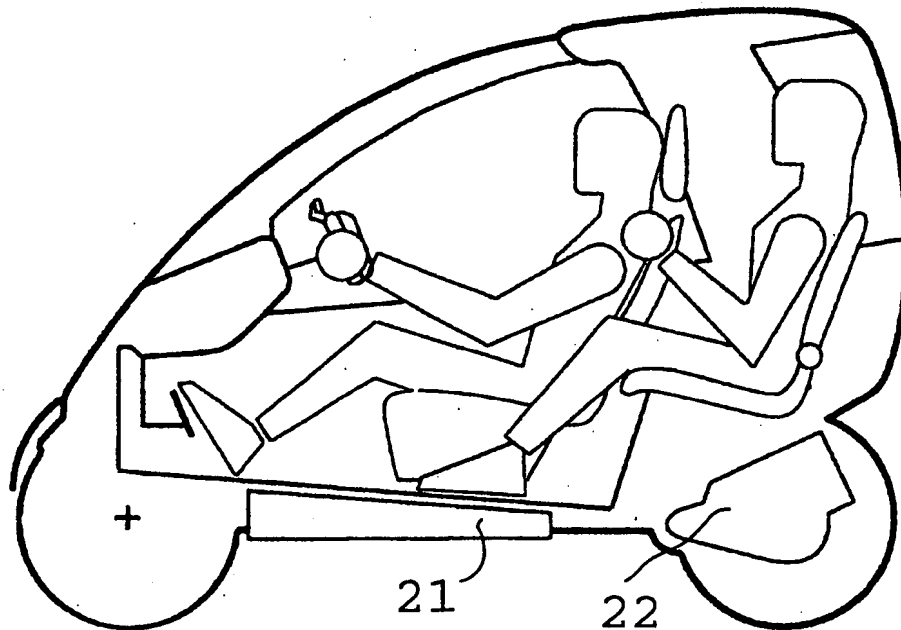


FIG. 14

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FIG. 15

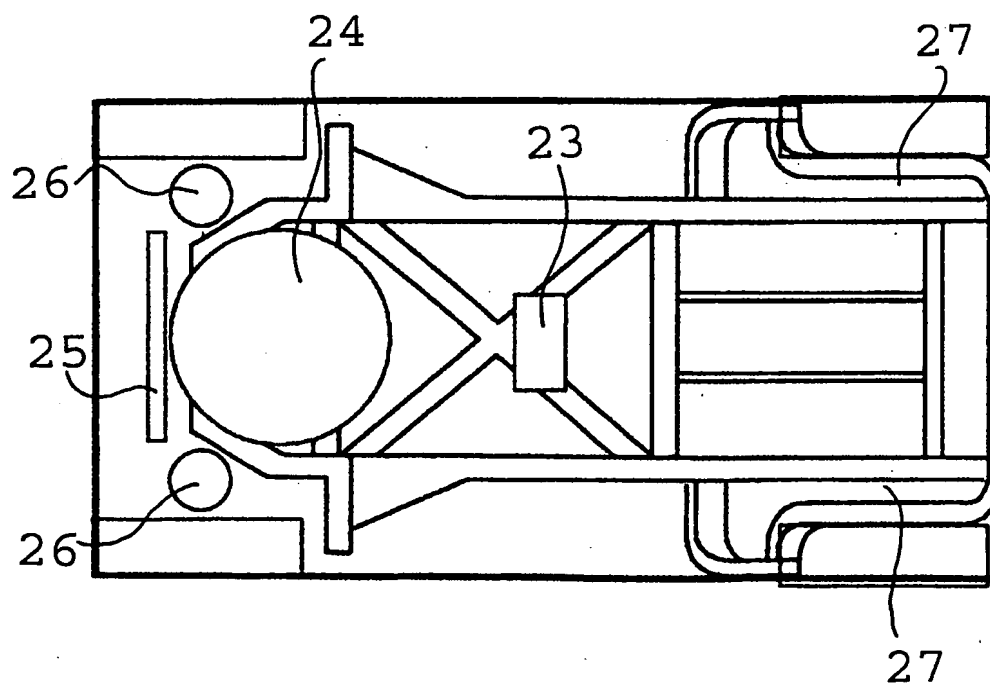
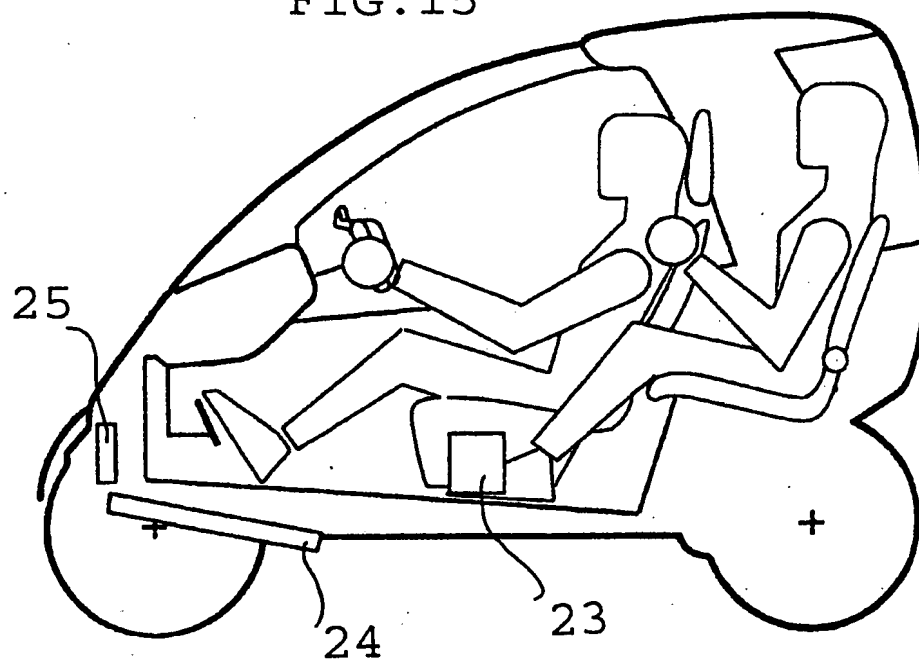


FIG. 16

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 99/00685

**A. CLASSIFICATION OF SUBJECT MATTER**  
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According to International Patent Classification (IPC) or to both national classification and IPC

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IPC 6 B62D B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 829 417 A (D'ASCANIO) 18 March 1998 (1998-03-18) claim 16; figures 1,2 ---	1,5,7
X	WO 96 05979 A (MENKEN) 29 February 1996 (1996-02-29) abstract; figures ---	1
A	FR 2 383 817 A (LIAUTAUD) 13 October 1978 (1978-10-13) figure ---	1
A	FR 2 716 858 A (MERCEDES-BENZ) 8 September 1995 (1995-09-08) abstract; figures 4,5 ---	1-3, 5-11,14, 15
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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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